Carotid Aneurysm Review

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Int J Angiol 2019;28:17–19.

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Abstract

Aneurysms of the carotid artery are rare with multiple underlying etiologies. Treatment is largely open surgery but medical and endovascular therapies have been used based on presentation, anatomy, and etiology. There is a moderate amount of retrospective case series data on surgical results but no prospective data or data comparing open versus endovascular therapy exists. Much research is still needed but difficult to obtain in this rare disease process.

Keywords

- carotid aneurysm
- extracranial carotid aneurysm
- pseudoaneurysm
- treatment
- etiology
- presentation

Aneurysms are a rare pathology of the carotid arteries. It is estimated that 0.1 to 2% of all carotid procedures are performed for aneurysm disease.[1,2] It also only accounts for 0.4 to 4% of all peripheral artery aneurysms.[3–5] Many large institutions may only see one of these per year, but given its potential for serious complications it is important for the clinician to understand the pathology and treatments.[3]

Since the first reported successful treatment of a carotid artery aneurysm by Sir Astley Cooper in 1808, in which he ligated the proximal carotid artery, there have been multiple treatments options that include medical therapy, open surgical therapy, and endovascular therapy.[6] In 1956, Dimtza performed the first resection of the carotid artery for aneurysm disease.[7] In the past couple decades, there has been an increase in endovascular therapies; however, the total data on this is relatively scarce without great long term follow-up and needs further investigation.

Clinical Presentation

Patients with carotid aneurysms present in multiple ways. Most patients are of male gender with studies ranging from 49 to 86% male predominance. Depending on the etiology of the aneurysm, patients of multiple age ranges are noted from 19 to 95; however, most are in the 6th or 7th decade of life. In the era of modern imaging, many asymptomatic carotid aneurysms are discovered incidentally. However, larger aneurysms frequent cause symptoms. Patients that present with a pulsatile mass range from 12 to 93%. Between 12 and 51% of patients present with a cerebral ischemic event. Multiple other presenting symptoms that occur less frequently include cranial nerve deficit, infection, dysphagia, tinnitus, bruit, hemorrhage, hoarseness, tracheal obstruction, and dizziness.[3,8–10]

Etiology

Current literature on aneurysms of the carotid artery is actually a collection of true and false aneurysms with multiple underlying etiologies. The two most predominate groups are atherosclerotic and pseudoaneurysms, which compose of 35 to 66% and 12.5 to 82% aneurysms respectively, in most large series. Pseudoaneurysms are most often related to prior carotid endarterectomy and occasionally infectious. Other less common etiologies include true mycotic aneurysm, trauma, fibromuscular dysplasia, spontaneous dissection, connective tissue disorders, prior radiation, and congenital defects.[3,8–11]

Treatment

Treatment is tailored to the individual patient without one specific type of treatment recommended for all carotid aneurysms. The goal of therapy is to prevent local mass

published online
February 27, 2019

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Tel: +1(212) 584-4662.

DOI https://doi.org/10.1055/s-0039-1677675.
ISSN 1061-1711.

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Table 1 Current literature on carotid aneurysms with associated mortality and morbidities

Author date	Number of aneurysms	True aneurysms vs. pseudoaneurysms vs. traumatic	Open surgery vs. endovascular vs. medical therapy	Mortality (%)	Perioperative stroke (%)	Cranial nerve injury (%)
Rhodes 1976[15]	23	16/3/4	21/0/2	0	10	5
McCollum 1979[4]	37	16/19/2	28/0/9	7	11	0
Sundt 1986[16]	20	3/1/7	20/0/0	0	6	25
Bower 1991[17]	25	3/10/8	25/0/0	4	4	35
Moreau 1994[18]	38	12/1/6	38/0/0	2.6	5.3	66
Faggioli 1996[19]	24	21/2/1	24/0/0	4.2	4.2	21
El-Sabrout and Cooley 2000[3]	67	23/38/6	67/0/0	6	8	6
Zhou 2006[8]	42	22/15/5	28/14/0	7	2.4	9.5
Attigah 2009[9]	64	42/8/0	64/0/0	0	1.6	6.3
Pulli 2013[10]	50	19/31/0	47/3/0	0	6	10
Fankhauser 2015[a]	141	25/103/13	48/18/75	0.7	0.7	–

[a]Only discussed aneurysm-related death and did not mention all cause 30-day mortality, did not report cranial nerve injury.

effect, rupture, and neurologic deficits from either embolization or thrombosis. A host of treatments have been tried over the years. These range from medical management with surveillance, to open surgical interventions, and then to more recently endovascular options.

Medical therapy of carotid aneurysms has mostly been derived from the Mayo Clinic experience (►**Table 1**). Fankhauser and colleagues examined 141 carotid aneurysms diagnosed in 132 patients over 15-year period in Mayo Clinic.[11] Seventy-five aneurysms were treated nonoperatively. Treatment included antiplatelet therapy, anticoagulation, or serial imaging per the treating clinician. Most of the patients were asymptomatic and were in patients that had prior imaging showing stability to the aneurysm. During the study period, none of the patients treated medically died or suffered major morbidity related to the aneurysm. One did have significant growth but nonsurgical intervention was elected due to the patients' age.[11]

Open surgical approaches vary depending on anatomy and underlying pathology. These can include: ligation, resection with primary repair, resection with interposition graft, resection with patch repair of the artery. Prior studies show resection with interposition occurring around 14 to 57% of the time, resection with primary anastomosis occurring 6 to 31%, resection with patch angioplasty 9.5 to 66%, and ligation occurring much less at 0 to 1.6%.[3,8–10]

Ligation of the internal carotid artery is primarily reserved for emergency situations, such as arterial rupture. This is especially true when infection is considered the primary etiology. Most typically these patients are placed on anticoagulation to prevent embolization as the internal carotid artery progressively fills with thrombus. Recommended duration of anticoagulation is not standardized, but 2 weeks to 3 months therapy duration has been described by a few groups.[12,13]

El-Sabrout and Cooley have shown good results with resection of pseudoaneurysm that are associated with prosthetic patches back to normal healthy artery and performing repeat patch angioplasty.[3] Concern for infection in these situations should be high and one should consider autologous patch. A large number of pseudoaneurysms were reported with prior Dacron patches in one series. Silk stitches were also associated with higher rates of aneurysmal degeneration.

Open surgical results nearly always achieve a technical success but do vary in surgical risk. Early risk of mortality ranges from 0 to 7%, perioperative stroke 0.7 to 11%, cranial nerve injury 0 to 66%, hematoma 0 to 5%, acute renal failure 0 to 1.5%, thrombosis 0 to 6%, myocardial infarction 0 to 1.7%, and infection 0 to 1.7%.[3,8–10] Cranial nerve injuries include facial, vagus, spinal accessory, hypoglossal, and glossopharyngeal nerves. To reduce risk of embolization, meticulous dissection as one would do during carotid endarterectomy is suggested along with minimal manipulation of the aneurysm. A brief summary of these results is presented in ►**Table 1**.

The endovascular approach to carotid aneurysm disease has become more popular as endovascular techniques and technologies have improved. Li and colleagues recently performed a systematic review of the endovascular management of carotid artery aneurysms. They gathered all available published data on endovascular treatment of carotid artery disease and combined the data. Number of patients treated by endovascular means were 224 with nearly half of the aneurysms being attributed to trauma. The average diameter of the aneurysms was 26.3 mm. The internal carotid was also the most common site of aneurysm location. Forty-three percent of patients had neurologic dysfunction at the time of treatment. Covered stents were used 68% of the time with 83% of true aneurysms being treated with a covered stent

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and 67% of pseudoaneurysms being treated with a covered stent. Twenty-two different types of stents were identified and data was either unknown or not available for 27 of the treated aneurysms. Procedural success was noted in 100% of true aneurysms and 92.4% of pseudoaneurysms. Average duration follow-up was 15.4 months. For covered stents the stent graft patency was 91.8% with an aneurysm sac thrombosis rate of 95.8%; compared with bare metal stents which had a stent patency of 97.1% and an aneurysm sac thrombosis rate of 70.6%. Late complications were 8.3 and 23.5%, respectively. Overall occlusion rate was 6.3%. Stroke rate was 2.5% with covered stents, and none seen with the with the bare metal stents (0/37).[14]

Conclusion

Carotid aneurysm is an uncommon disease process with diverse etiology but are clinically important to understand and know how to treat. They pose a significant problem in regards to potential for neurologic complications and many are first recognized secondarily to stroke or transient ischemic attack. Treatments include medical management, open surgery, and endovascular intervention and should be individualized to the patient for best outcome.

Open surgical intervention has been the mainstay treatment for carotid aneurysm disease for years but endovascular therapy has shown it also to be effective. While we do have some data in regards to endovascular therapy, the long-term data are lacking and the number of patients studied are still relatively few. Most of the data in both open and endovascular intervention are retrospective case series or case reports. There is no clear guideline, expert consensus, or treatment algorithm for the treatment of this disease. Much research is still needed to guide best therapy, especially as treatment modalities continue to change.

Conflict of Interest
None.

Acknowledgment
None.

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